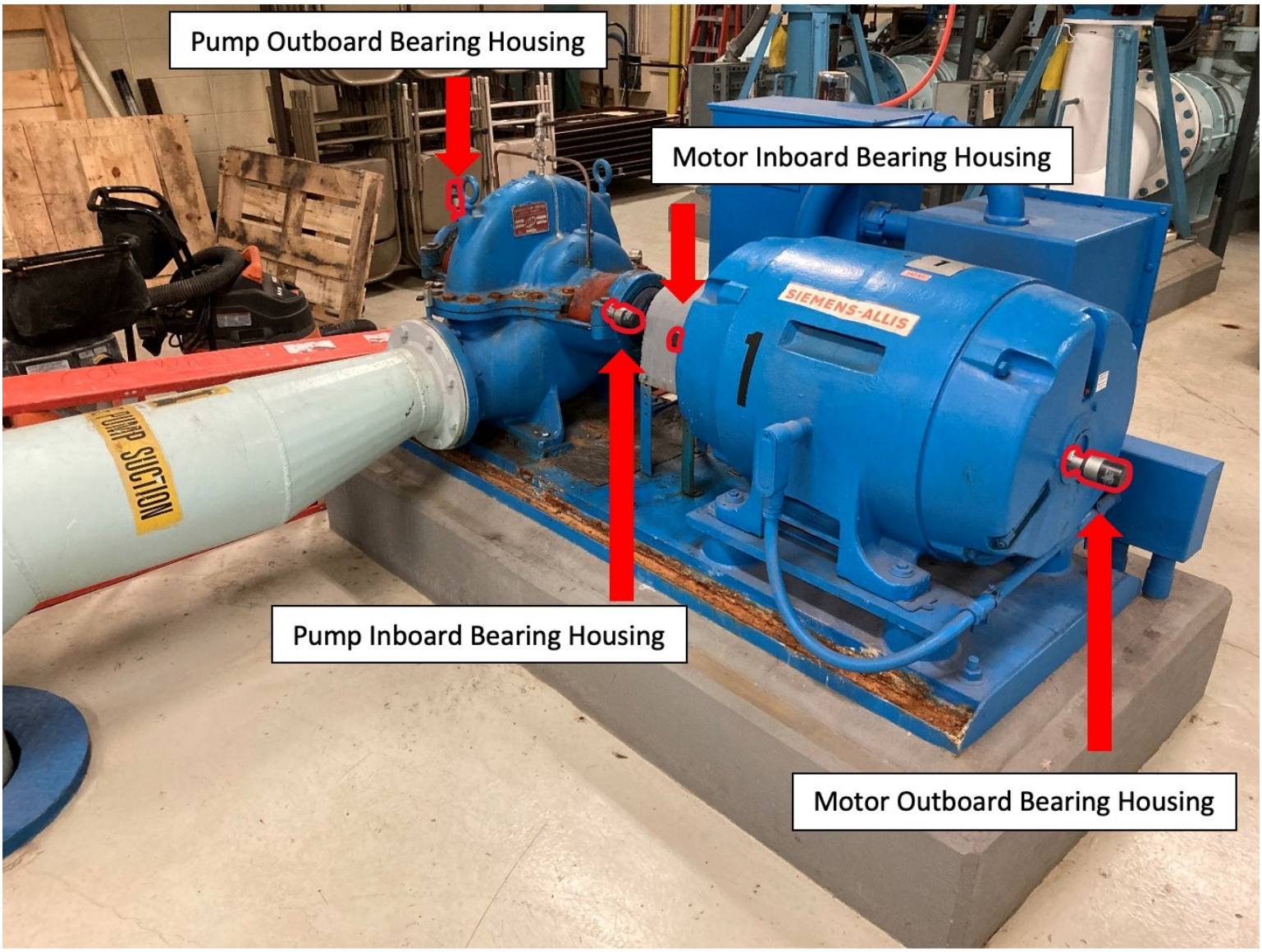
Hydro, Inc.'s Centaur IIoT Solution Detects Cracked Coupling at Municipal Wastewater Treatment Plant

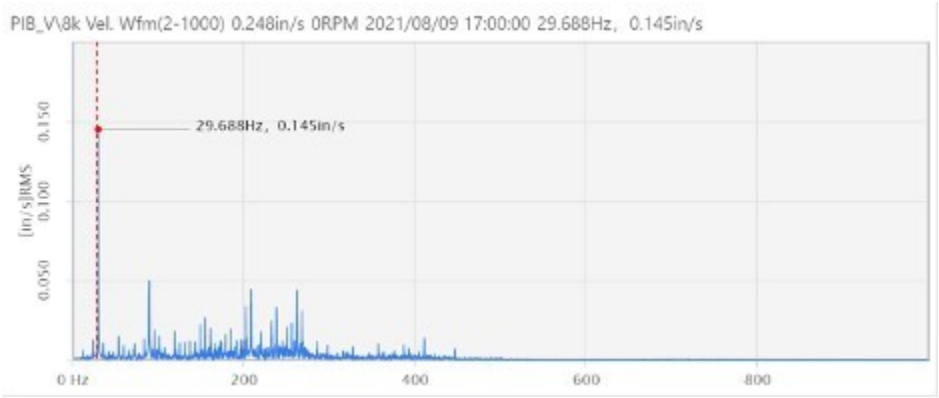
Hydro recently began monitoring several pump-motor trains at a municipal wastewater treatment plant using Hydro's condition monitoring solution, Centaur. Centaur collects and stores real-time vibration and temperature levels. Hydro's in-house analysts use this data to support end-users by evaluating equipment condition and making recommendations to minimize downtime and maximize the lifespan of the monitored machinery.



For this installation, the Centaur engineering team outfitted wireless accelerometers at specific points on multiple machine trains. The monitored locations include the motor outboard bearing housing, motor inboard bearing housing, pump inboard bearing housing, and pump outboard bearing housing, as shown below.

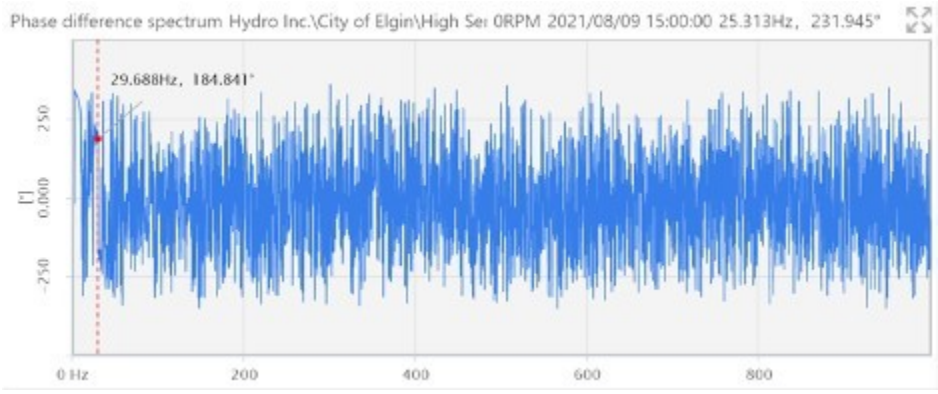
Using Hydraulic Institute standards, specifically ANSI/HI 9.6.4 for BB (between-bearing) and OH (overhung) pumps, Hydro assisted the end user in establishing alarm thresholds for each machine. Centaur's web-based software platform was then configured to send automated email alerts to the Centaur team and the end-user when a targeted alarm threshold is crossed. In early August, the Alarm 2 threshold (>0.250 ips RMS) was crossed at the pump inboard bearing location in the vertical direction. The trend plot below shows the upward trend in vibration amplitude levels and the Alarm 2 level (shown in purple).

The monitored data identified a dominant excitation frequency at 1x run speed (29.688Hz) with harmonics. The team at Hydro's Monitoring & Diagnostic Center suspected that misalignment may be the root cause of the elevated vibration amplitude readings.



Phase analysis was performed between the pump inboard sensor location and the motor inboard sensor location. The phase angle is an important parameter to monitor, as it indicates relative motion between two locations of measurement.

The phase difference, shown in the chart below, revealed a 184.841˚ phase difference between the pump inboard sensor and the motor inboard sensor. This phase angle is indicative of a potential misalignment condition between the coupled components.



To confirm our suspicions, Hydro reached out to on-site personnel and asked for additional information that could help validate the misalignment theory. While gathering information, the site scheduled maintenance on the pump and found that the inboard coupling was cracked. Upon replacing the coupling, the vibration amplitude levels dropped below the warning threshold (<0.150 ips RMS), as shown in the trend plot below.

Prior to replacing the coupling, the pump had not been taken apart for 7 years and no notable signs of faults had been detected. If the Centaur system had not detected the cracked coupling, the pump may have reached a point of catastrophic failure, leading to extensive damage to the shaft and/or bearing. By catching this fault early, Hydro helped ensure that the customer's pump could be brought back to acceptable condition with only minor maintenance.